IMEC100.001DV1

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	09/844,959
Appl. No.	:	Baklanov, et al.
Filed	:	April 27, 2001
For	:	FLUORINATED HARD MASK FOR MICROPATTERNING OF POLYMERS
Examiner	:	Trinh, H.
Group Art Unit	:	2814

DECLARATION UNDER 37 CFR §1.132

OF MIKHAIL BAKLANOV

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

I, Mikhail Baklanov, declare as follows:

1. I am a citizen of Belgium, residing at Tulpenlaan 15, 3020 Veltem-Beisem (Belgium), and believe that I are the original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled "FLUORINATED HARD MASK FOR MICROPATTERNING OF POLYMERS"; the specification of which was filed on April 27, 2001, as Application Serial No. 09/844,959.

2. I have reviewed the Office Action Mailed January 5, 2005, and the two references cited against pending Claims 11-14 in an obviousness rejection: U.S. 6,066,577 to Cooney III, et al. and U.S. 6,309,956 to Chiang et al.

3. Cooney, III et al. discloses an integrated circuit structure including an upper fluorine-free barrier layer 28 deposited on a fluorine rich insulating layer 22, prepared by fluorine doping a conventional silicon dioxide or amorphous carbon layer. The fluorine rich insulating layer 22 is incapable of functioning as a hard mask layer, because it is the fluorine rich insulating layer itself that is etched – the insulating layer cannot function as its own hard mask. Likewise, the

upper fluorine-free barrier layer 28 is also unsuitable for use as a hard mask layer to dielectric layers below due to its small etch selectivity – the barrier layer would be consumed if one attempted to use it as a hard mask during etching.

4. Chiang, et al. discloses an interconnect structure including an organic polymer dielectric 140 (see col. 5, lines 50-53). This organic polymer dielectric is also unsuitable for use as a hard mask layer, as it lacks the chemical resistance necessary to withstand etching conditions. Chiang did not have the intention to use part of the organic low-k material as a hardmask (not goal of the patent).

5. I and my co-inventors have unexpectedly discovered that fluorinated organic polymer films are capable of functioning as effective hard mask layers for an underlying dielectric layers. A fluorinated silicon dioxide layer is unsatisfactory for use as a hard mask layer. While fluorination of a silicon dioxide layer lowers the k-value of the layer, the incorporation of fluorine in a silicon dioxide layer does not impart to the modified layer the functionality necessary for the layer to function as a hard mask, due to selectivity problems in dry etch processing. Compared to incorporation of fluorine into an organic polymer film, incorporation of fluorine into a silicon dioxide layer is significantly more limited -- a maximum of about 4% fluorine can be incorporated into a silicon dioxide layer. As a result, the difference in etch selectivity of the fluorinated silicon dioxide layer and the underlying silicon dioxide dielectric layer is too small (a mere 10% up to a maximum of 30% difference in etch rate) to permit the fluorinated silicon dioxide layer to function as a hard mask for an underlying dielectric layer – both layers would be consumed in the etch process. In contrast, the difference in etch selectivity of the fluorinated organic polymer film and the underlying dielectric layer is substantially higher (a difference in etch rate of about 8 to about 10 times, see Figure 2 of patent application). The fluorinated organic polymer film hard mask layer can therefore withstand the etch process while the underlying dielectric is consumed.

6. I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

7. The undersigned Applicant declares further that all the statements made herein of his or her own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title

18 of the United States Code and that such willful, false statements may jeopardize the validity of the application or any patent issuing thereon.

Dated: April 5, 2005

[Mikhail Baklanov]

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